

## Today's Objective

- **Assess** the domain, and range of relations and functions. Provide supporting evidence with key words in writing using sentence stems.
- Success Criteria
  - Relate domain and range to dependency relationship and mapping
  - Use a graphical representation to analyze a function
  - Apply step-by-step process for finding domain and range
- **Vocabulary:** domain, range, function, set, element, mapping, vertical

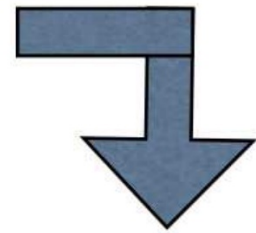
## Function, Domain, and Range

A function from a set  $D$  to a set  $R$  is a rule that assigns to every element in  $D$  a unique element in  $R$ . The set  $D$  of all input values is the domain of the function, and the set  $R$  of all output values is the range of the function.



Domain: What you can put into your function  
Dirty laundry

The washing machine is like  
your function

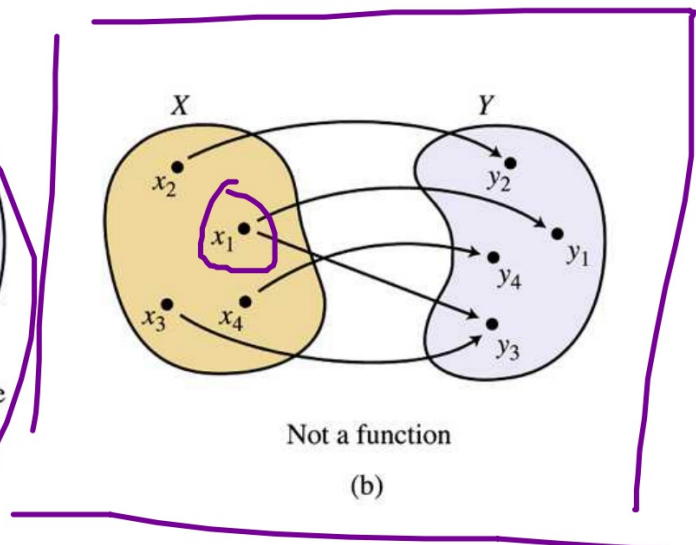
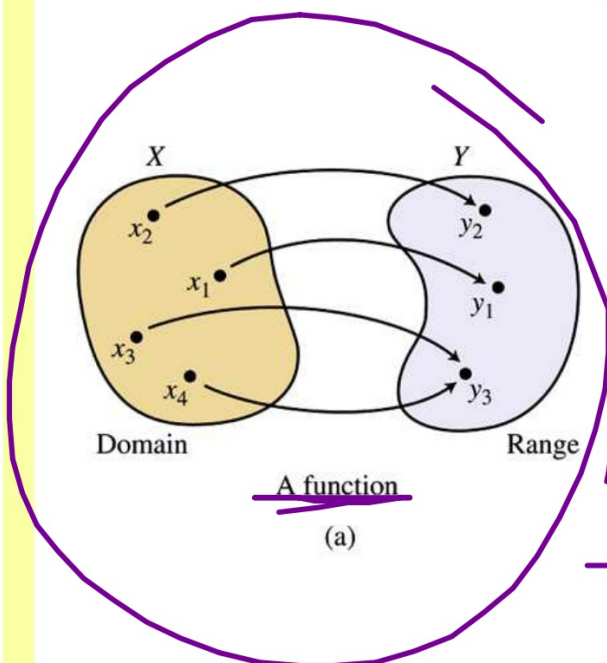


Range: What comes out of your function  
Clean, wet laundry

## What is a **function**?

- A relation that associates each value in the domain ( $x$ ) with exactly one value in the range ( $y$ ).
- Example: If you have a 'functioning' relationship, you are seeing only one person. (If you are seeing more than one person, your relationship is not functioning)

## Mapping



## Vertical Line Test

A graph (set of points  $(x,y)$ ) in the  $xy$ -plane defines  $y$  as a function of  $x$  **if and only if** no vertical line intersects the graph in more than one point.

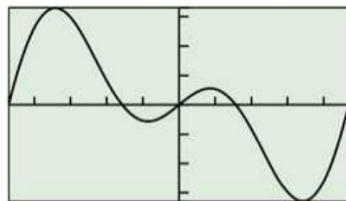
If \_\_\_\_\_, then \_\_\_\_\_.



## Example Seeing a Function Graphically

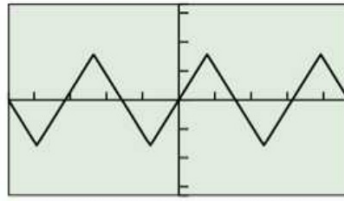
Of the three graphs shown below, which is not the graph of a function?

### ■ Support your answer



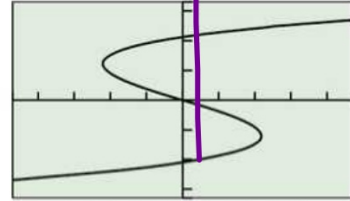
$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(a)



$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(b)

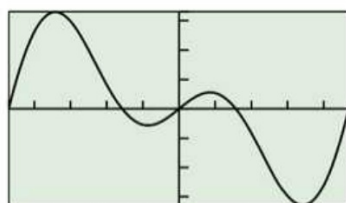


$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(c)

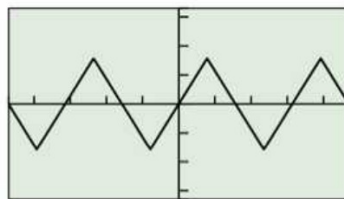
## Example Seeing a Function Graphically

Of the three graphs shown below, which is not the graph of a function?



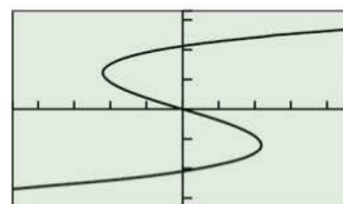
$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(a)



$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(b)



$[-4.7, 4.7]$  by  $[-3.3, 3.3]$

(c)

The graph in (c) is not the graph of a function.

There are three points on the graph with x-coordinates 0.



**AM: Evaluate functions for given values**

1. Let  $f(x) = |x| - 2$ . Find  $f(5)$ .

[A] 3 [B] -3 [C] -7 [D] 7

$$\begin{aligned} f(5) &= |5| - 2 \\ &= 5 - 2 \\ &= 3 \end{aligned}$$

### AM: Evaluate functions for given values

2. Find  $f(15)$  for  $f(x) = \frac{x^2 - 9}{27 - x^3}$ .

[A]  $\frac{1}{8}$

[B]  $\frac{1}{12}$

[C]  $-\frac{2}{31}$

[D] none of these

$$f(15) = \frac{(15)^2 - 9}{27 - (15)^3} = -\frac{2}{31}$$

AM: Evaluate functions for given values

3. If  $Q(x) = x^2 + 5x - 6$ , find  $Q(-3)$ . [A] 18 [B] 0 [C] -12 [D] 12

$$\begin{aligned} Q(-3) &= (-3)^2 + 5(-3) - 6 \\ &= 9 - 15 - 6 \\ &= -12 \end{aligned}$$

AM: Evaluate functions for given values

4. Let  $f(x) = |x| - 4$ . Find  $f(-5)$ .

## AM: Domain and range, relations and functions

1. Find the domain of the relation  $\{(-4, 3), (-6, -5), (4, 1)\}$ .

[A]  $\{-4, -6, 4\}$

[B]  $\{3, -5, 4\}$

[C]  $\{3, -5, 1\}$

[D]  $\{-4, -6, 1\}$

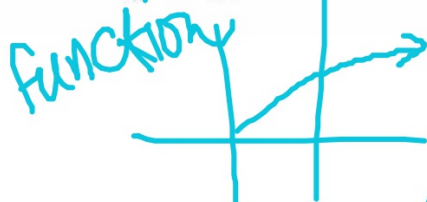
## AM: Determine if relations are functions

1. Which of the following is *not* a function?

[A]  $x = 2y^2 + 4$



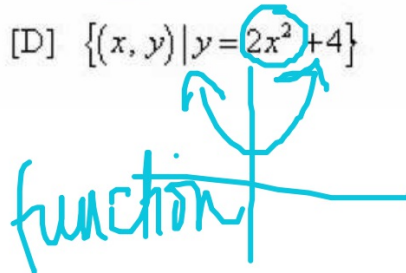
[C]  $\{(x, y) | y = 2\sqrt{x}, x \geq 0\}$



[B]  $\{(3, -4), (-5, 2), (-1, -4)\}$

function

[D]  $\{(x, y) | y = 2x^2 + 4\}$



LO: The relation A is not a function because there exist inputs  $x$  which are assigned

two output or y values. Graphically the relation in A fails the vertical line test.



### AM: Determine if relations are functions

2. Which of the following is a function?

~~[A]~~  $\{(-8, -5), (-5, -4), (-8, -3)\}$

~~[B]~~  $\{-8, -5, -4, -3\}$

~~[C]~~  $\{(-8, -5), (-4, -3), (-4, -8), (-3, -4)\}$

[D]  $\{(-8, -5), (-5, -8), (-3, -3)\}$

LO: The relation D is a function because  
there every inputs  $x$  is assigned one  
output or 1 values.

### AM: Determine if relations are functions

3. Which of the following data represents wind speed as a function of lift?

[A]

wind speed (m / h)	10	20	30	40
lift (ft / s)	7.5	13	17.9	21

[B]

wind speed (m / h)	10	20	30	40
lift (ft / s)	19.8	24.8	19.8	28.1

[C]

wind speed (m / h)	10	20	30	40
lift (ft / s)	5.2	9.2	12.9	9.2

[D] none of these

lift = x

LO: The relation \_\_\_\_\_ represents a function because every  $x$  is assigned \_\_\_\_\_ output or \_\_\_\_\_ values.

**AM: Determine if relations are functions**

4. Is the relation  $\{(x, y) | x = 3y^2 + 1\}$  a function?

LO: The relation \_\_\_\_\_ is \_\_\_\_\_ a function because there exist inputs  $x$  which are assigned \_\_\_\_\_ output or \_\_\_\_\_ values. Graphically the relation in \_\_\_\_\_ fails the \_\_\_\_\_

## AM: Determine if relations are functions

1. Determine which relation is a function.

[A]

$x$	1	2	3	4
$y$	3	6	9	12

[B]

$x$	3	2	5	3
$y$	4	4	1	5

[C]

$x$	1	1	1	1
$y$	4	3	2	1

[D]

$x$	3	3	1	1
$y$	4	3	2	5

LO: Relation \_\_\_\_\_ is a function because each input  $x$  is assigned exactly \_\_\_\_\_ output or \_\_\_\_\_ value. Relations \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ are \_\_\_\_\_ functions because there is \_\_\_\_\_ input  $x$  that is assigned \_\_\_\_\_ output or \_\_\_\_\_ values.

## AM: Determine if relations are functions

2. Which of the following is *not* a function?

[A]  $y = 2\sqrt{x}, x \geq 0$

[B]  $\{(0, 2), (5, 3), (4, 2)\}$

[C]  $x = 2y^2 - 1$

[D]  $y = 2x^2 - 1$

LO: The relation in \_\_\_\_\_ is \_\_\_\_\_ a function because there exist inputs  $x$  which are assigned \_\_\_\_\_ output or \_\_\_\_\_ values. Graphically the relation in \_\_\_\_\_ fails the \_\_\_\_\_.

## AM: Determine if relations are functions

3. Which of the following *is* a function?

[A]  $\{(x, y) \mid x^2 + y^2 = 25\}$

[B]  $\{(x, y) \mid x = y^2\}$

[C]  $\{(5, -6), (-2, -6), (4, -6)\}$

[D]  $\{(-6, 4), (-6, -3), (-3, 5)\}$

LO: Relation \_\_\_\_\_ is a function because each input  $x$  is assigned exactly \_\_\_\_\_ output or \_\_\_\_\_ value. Relations \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ are \_\_\_\_\_ functions because there is \_\_\_\_\_ input  $x$  that is assigned \_\_\_\_\_ output or \_\_\_\_\_ values.



## AM: Determine if relations are functions

4. Determine if the relation is a function:

$x$	1	1	1	1
$y$	4	3	2	1

LO: The relation \_\_\_\_\_ is a function because each input  $x$  is assigned exactly \_\_\_\_\_ output or \_\_\_\_\_ value.

*OR*

The relation is \_\_\_\_\_ functions because there is \_\_\_\_\_ input  $x$  that is assigned \_\_\_\_\_ output or \_\_\_\_\_ values.